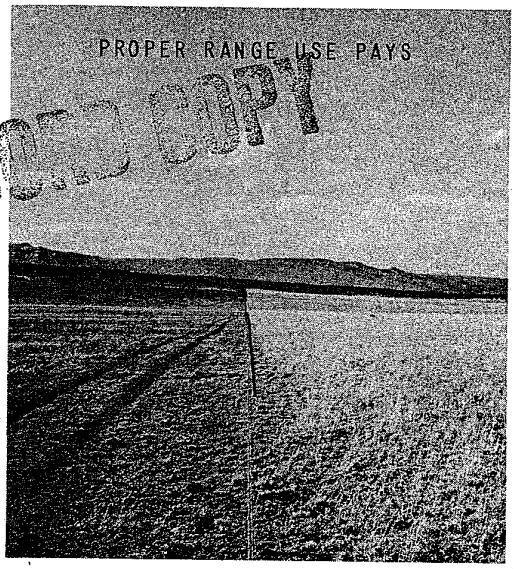
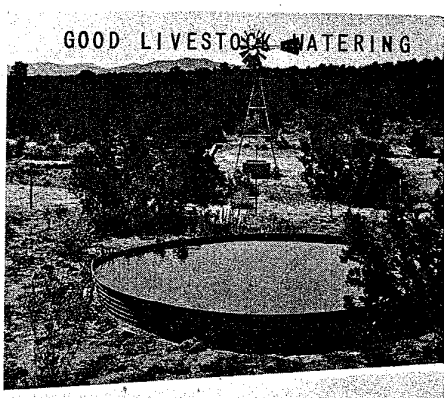
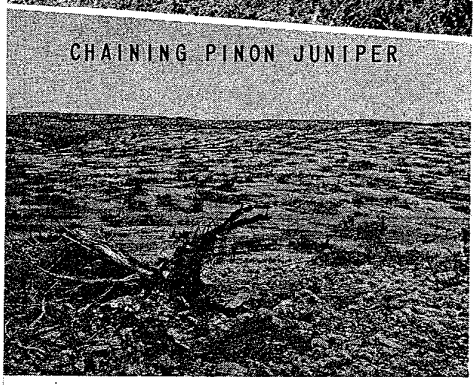
RANGE CONSERVATION - TECHNICAL NOTES







U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
NEW MEXICO

RANGE TECHNICAL NOTE No. 16

February 17, 1967

Subject: SUMMER DEFERRED GRAZING
RANGE UTILIZATION PATTERNS

Attached are two reports from the Rocky Mountain Forest and Range Experiment Station, on research done in the Rio Puerco drainage in west central New Mexico. Important findings reflected in these papers are:

1. The great increase in alkali sacaton (400%), galleta (290%), and blue grama (206%), resulting from six years of summer deferred grazing.

2. Fencing did not greatly change utilization patterns on small watersheds grazed by yearling cattle.

3. The most uniform utilization of rough terrain was made by yearling heifers.

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U.S. FOREST SERVICE
RESEARCH NOTE RM - 33

FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE
ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Changes in Perennial Grass Cover Following Conversion from Yearlong to Summer-Deferred Grazing in West Central New Mexico[1]

Wayne C. Hickey, Jr. and George Garcia[2]

The Rio Puerco drainage in west central New Mexico has been heavily used by livestock since the days of the early Spanish settlers.[3] Under close, yearlong grazing the vegetation deteriorated.

To determine whether improved management might help to rehabilitate those lands, livestock were excluded from three experimental watersheds during summer months over a 6-year period. Changes in the ground cover index during that time are compared with those during a 6-year period under yearlong grazing. The watersheds were used to test recovery as a cooperative project with the Bureau of Land Management.

[1]*Research reported here was conducted in cooperation with the Bureau of Land Management, U. S. Department of Interior.*

[2]*Range Conservationist and Forestry Research Technician, respectively, located at Albuquerque, in cooperation with the University of New Mexico; central headquarters maintained at Fort Collins, in cooperation with Colorado State University. Mr. Hickey is now Range Conservationist with Region 3, U. S. Forest Service, Albuquerque.*

[3]*Dortignac, E. J. Watershed resources and problems of the Upper Rio Grande Basin. 107 pp., illus. Rocky Mountain Forest and Range Expt. Sta., Ft. Collins, Colo. 1956.*

Study Site

The San Luis experimental site lies in the north central portion of the Rio Puerco drainage, 58 miles northwest of Albuquerque, New Mexico, in the transition zone between semi-desert grassland and woodland. The three watersheds are: WS I, 555 acres, WS II, 471 acres, and WS III, 338 acres. Annual precipitation for the area averages around 10 inches. The soils, which are alluvial, were derived principally from Mancos shale and cretaceous sandstone and are now severely gullied.

Principal forage species are alkali sacaton (Sporobolus airoides Torr.), galleta (Hilaria jamesii (Torr.) Benth.), and blue grama (Bouteloua gracilis (H. B. K.) Lag.). Fourwing saltbush (Atriplex canescens (Pursh) Nutt.) and big sagebrush (Artemisia tridentata Nutt.) are the principal shrubs.

Methods of Study

During the 6-year period ending May 1, 1957, the three watersheds were grazed by cattle yearlong; during the next 6 years they were grazed during winter months only (November through April).

Herbage production of each of the principal forage species was determined each fall after the first frost by a weight-estimate[4] and double-sampling technique.[5] Weight of each species, in grams, was estimated on nine permanent 9.6-square-foot plots at each of 25 sampling spots randomly located on each of the three watersheds. At the sampling spot, weight of herbage on a tenth 9.6-square-foot plot was estimated; then the herbage was clipped and weighed. The relationship between estimated and actual weights was used to adjust the estimate of the herbage weight on permanent plots.

Stocking rates were adjusted annually on the basis of herbage production. The objective was to utilize 55 percent of alkali sacaton.

Utilization was estimated about May 1 each year by the ocular estimate-by-plot method.[6] Mesh wire utilization cages, 9.6 square feet in size, were located at each sampling spot. They were relocated each spring on previously grazed spots to insure that new summer growth was measured. The cages provided examples of ungrazed forage at each site to help the examiner judge utilization.

Ground cover index was taken on 24 clusters of three 100-foot transects randomly distributed over each of the three watersheds. Records from them provided an index to changes in the three principal grass species. Measurements were taken in 1952, 1955, 1958, 1961, and 1963.

A network of nine open standard and four recording rain gages distributed over the three watersheds provided precipitation records. Precipitation was measured weekly from May 1 to November 1. The overwinter measurement period extended from November 1 to May 1 of each year.

[4] *Pechanec, J. F. and Pickford, G. D. A weight estimate method for the determination of range or pasture production. Amer. Soc. Agron. Jour. 29(1): 894-904. 1937.*

[5] *Wilm, H. G., Costello, D. F., and Klipple, G. E. Estimating forage yield by the double-sampling method. Amer. Soc. Agron. Jour. 36: 194-203. 1944.*

[6] *Pechanec, J. F. and Pickford, G. D. A comparison of some methods used in determining percentage utilization of range grasses. Jour. Agr. Res. 54: 753-765. 1937.*

Results

Utilization

Annual utilization varied widely, but much more under yearlong grazing than under deferred grazing. During the 6 years of continuous yearlong grazing, average utilization of alkali sacaton ranged from 11 to 87 percent in comparison with 32 to 70 percent under summer-deferred (November through April) use only (table 1).

Table 1.--Utilization of alkali sacaton on San Luis watersheds under yearlong and summer-deferred grazing

Grazing pattern and year	WS I	WS II	WS III	Average
		Percent		
Yearlong grazing:				
1952	50.0	60.0	65.0	58.3
1953	24.0	24.0	25.0	24.3
1954	23.0	10.0	0	11.0
1955	47.6	48.0	38.2	44.6
1956	38.6	45.4	33.8	39.3
1957	87.0	87.7	87.2	87.3
Summer-deferred grazing:				
1958	37.0	27.7	31.8	32.2
1959	54.2	48.2	59.7	54.0
1960	71.5	70.0	69.6	70.4
1961	61.9	44.6	39.0	48.5
1962	40.1	34.2	40.0	38.1
1963	57.0	46.8	59.4	54.4

Precipitation

Annual precipitation fluctuated yearly, but the averages for the two periods of study are similar. From 1952 to 1957 annual precipitation averaged 9.83 inches; during the second period precipitation averaged 9.38 inches. Average annual precipitation (year beginning November 1) and growing-season precipitation (May 1 to November 1) are shown below:

	Average precipitation	
	Annual (inches)	Growing season (inches)
Yearlong grazing:		
1953-54	12.12	8.24
1954-55	6.86	5.95
1955-56	5.92	2.21
1956-57	12.23	8.35
1957-58	12.00	6.53
Summer-deferred grazing:		
1958-59	10.66	6.81
1959-60	10.28	5.33
1960-61	10.32	9.31
1961-62	6.47	2.70
1962-63	9.19	4.15

Ground Cover Changes Under Yearlong Grazing

During the yearlong grazing, ground cover index declined. Reductions for individual species ranged from 15 to 56 percent (table 2).

Table 2.--Ground cover index of the three principal grasses on the San Luis watersheds

Species and year	WS I	WS II	WS III	Average
		Percent		
Alkali sacaton:				
1952	1.00	1.51	2.47	1.66
1955	.74	1.28	2.24	1.42
1958	.56	1.06	1.67	1.10
1961	2.21	3.45	3.17	2.94*
1963	3.11	6.41	5.67	5.06*
Galleta:				
1952	2.92	2.13	1.75	2.27
1955	3.51	2.21	1.53	2.42
1958	3.22	1.42	1.17	1.94
1961	6.60	3.49	2.18	4.09*
1963	12.55	8.43	4.61	8.53*
Blue grama:				
1952	3.28	1.26	.36	1.63
1955	2.10	.61	.44	1.05
1958	1.47	.48	.19	.71
1961	3.15	.96	.53	1.55*
1963	4.25	1.43	.63	2.10*

*Increases were significant at .01 level.

Measurements taken in 1958 showed a greater decline in blue grama than in the other two species. Blue grama was reduced by 56 percent from the 1952 value, while galleta averaged a 15 percent decline and alkali sacaton a 34 percent decline during this period.

Ground Cover Changes Under Deferred Grazing

Under summer deferment, the ground cover index showed a marked change (table 2). Alkali sacaton increased 400 percent, with individual gains of 455, 505, and 240 percent for the respective watersheds. Galleta increased by 290 percent in WS I, 494 percent in WS II, and 294 percent in WS III. For the entire study area galleta increased an average of 359 percent. Average increase for blue grama was 206 percent, a percentage representing gains of 189 percent for WS I, 198 percent for WS II, and 232 percent for WS III.

Tests of summer-deferred grazing resulted in significant increases in cover index compared with yearlong grazing. Although these tests lacked control of utilization and weather elements, the change from a declining ground cover index to an increasing one suggests conversion from yearlong to summer-deferred grazing was beneficial. This change in grazing was mainly responsible for the ground cover increases in alkali sacaton, galleta, and blue grama.

Summary and Conclusions

1. Ground cover changes, production, and utilization of alkali sacaton, galleta, and blue grama were measured during 6 years of yearlong grazing and then during 6 years of summer-deferred grazing.
2. Under yearlong grazing, these perennial grasses declined; under summer-deferred grazing, they increased.
3. The evidence indicates that summer deferment of grazing may be a means of improving the condition of similar rangelands in New Mexico.

Agriculture --- CSU, Ft. Collins

July 1964

U.S. FOREST SERVICE
RESEARCH NOTE RM - 21

FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Range Utilization Patterns as Affected by Fencing and Class of Livestock[1]

Wayne C. Hickey, Jr. and George Garcia[2]

How to obtain uniform use of the range by livestock is an important and difficult problem in the Southwest. Stoddard and Smith[3] pointed out that "no western mountain range and few level ranges can be uniformly utilized." Utilization may reach 100 percent around water, but declines as distance from water increases.[4]

Many suggestions for obtaining uniform utilization have been advanced: cross fencing, salting away from water, fertilizing outlying areas, reseeding outlying areas to more preferred species, and using minerals or supplemental feeding in ungrazed areas. None of the past studies have indicated, however, how utilization patterns in fenced pastures may change when the pastures are grazed by different classes of livestock. Also, there is little information on changes in grazing patterns caused by fencing.

The objective of this note is to give an example of how fencing small watersheds and stocking them with different classes of cattle affected the grazing patterns at one location in the Rio Grande Basin.

STUDY SITE

The San Luis experimental site, 58 miles northwest of Albuquerque, New Mexico, consists of three adjacent watersheds (529, 525, and 364 acres), with southerly drainage, in the transition zone between woodland and semi-desert grassland. Principal forage species are alkali sacaton (Sporobolus airoides Torr.) and galleta (Hilaria jamesii (Torr.) Benth.). Average annual precipitation is 13 inches.[5]

Three distinct topographic types exist on the watersheds--"uplands," "breaks," and "alluvium" (figs. 1 and 2). The high, rocky hills of the "uplands," or headwaters, terminate in rocky "breaks," from which steep

[1] *Research reported here was conducted in cooperation with the Bureau of Land Management, U. S. Department of the Interior.*

[2] *The authors are Range Conservationist (Research) and Forestry Research Technician; Rocky Mountain Forest and Range Experiment Station, Albuquerque, New Mexico.*

[3] *Stoddart, Laurence A., and Smith, A. D. Range Management. 547 pp., McGraw-Hill Book Co., New York, New York. 1955.*

[4] *Holscher, Clark E., and Woolfolk, E. J. Forage utilization by cattle on northern Great Plains ranges. U. S. Dept. Agr. Cir. 918, 27 pp. 1953.*

[5] *U. S. Soil Conservation Service. Isohyetal Map, 1951.*

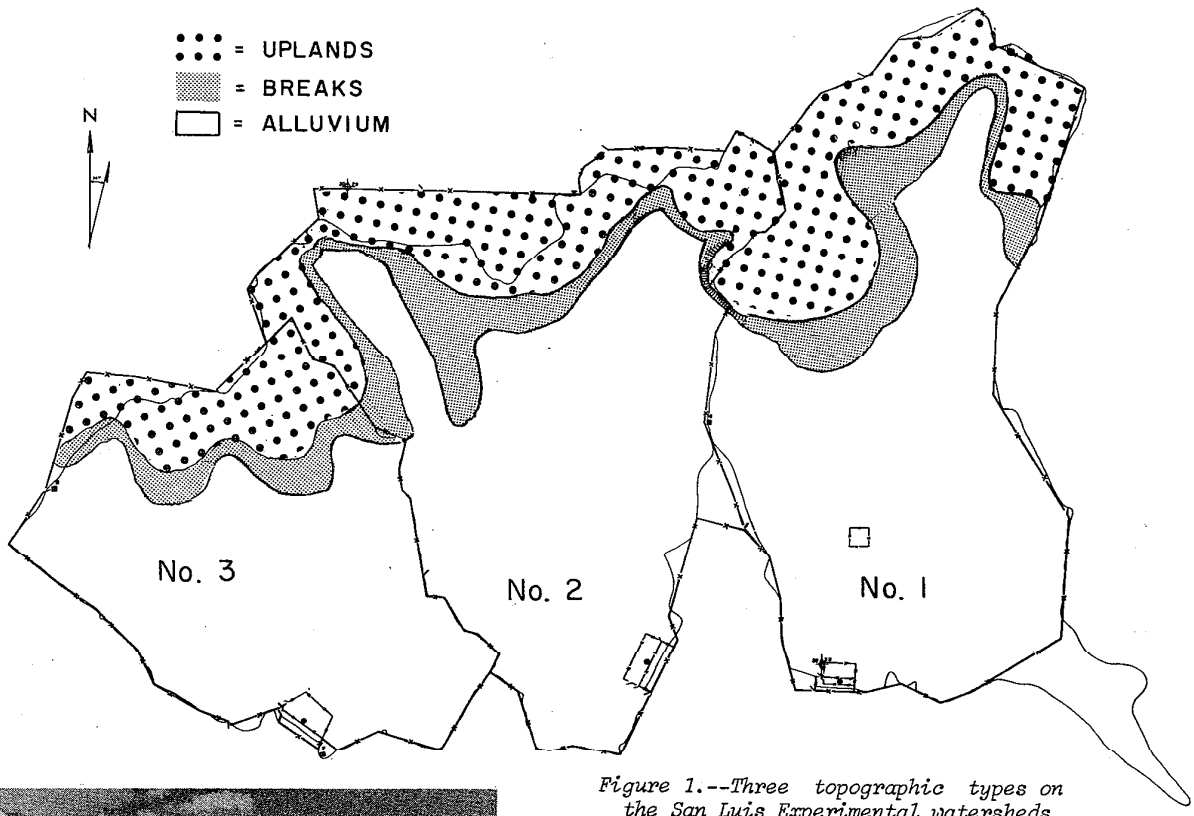


Figure 1.--Three topographic types on the San Luis Experimental watersheds.

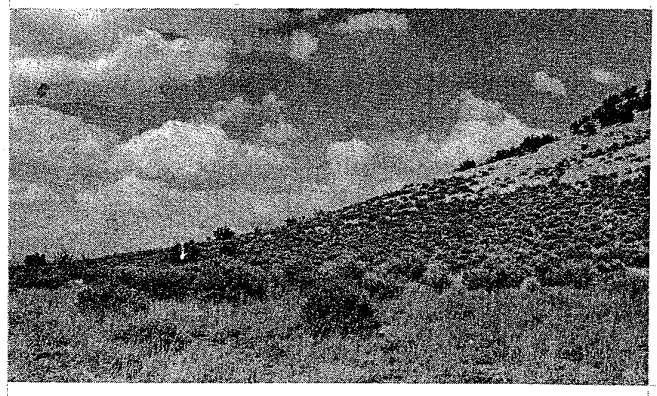
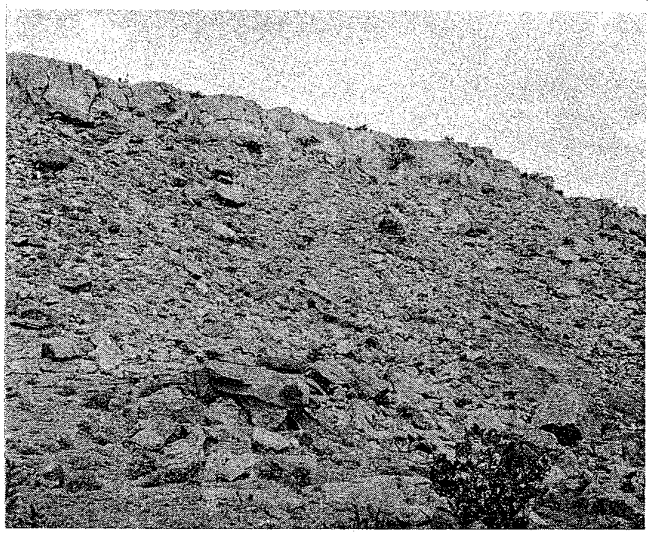


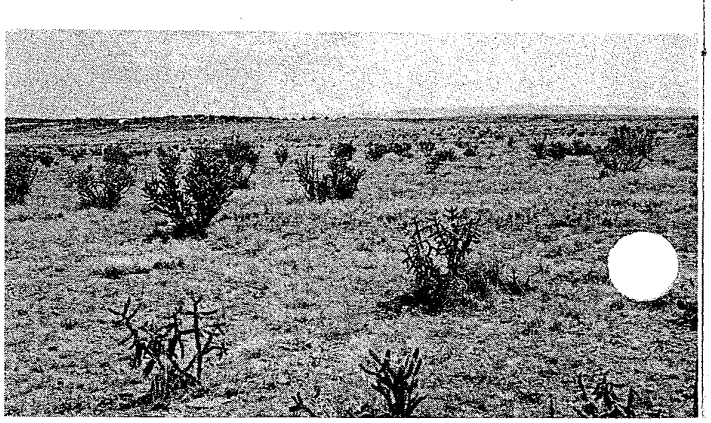
Figure 2.--On the San Luis watersheds, the three distinct topographic types are:

Uplands



Breaks

Alluvium



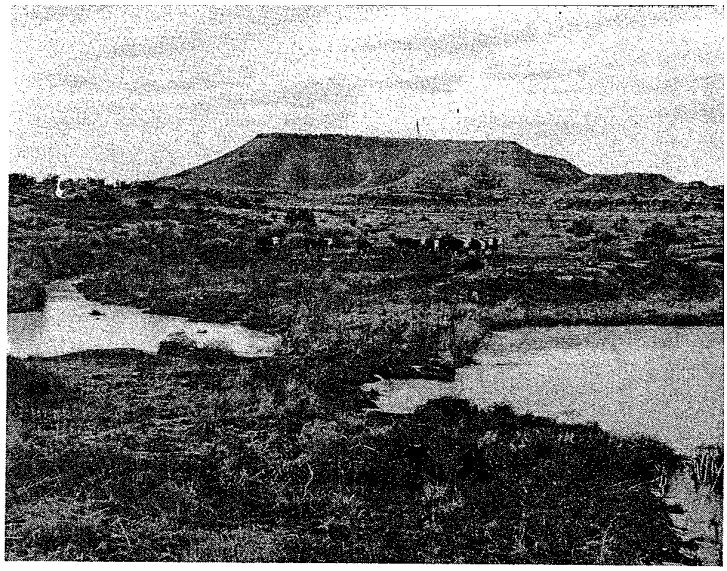


Figure 3.--A stock watering tank is located at the southern end of each watershed.

hillsides extend down to the gently sloping "alluvial" grassland. A stock watering tank is located in this grassland at the southern end of each watershed (fig. 3).

METHODS

The three watersheds were grazed from October to May each year (winter grazing) by various classes of Hereford cattle (table 1).

Prior to 1954, the watersheds were grazed by mixed classes of cattle and horses. Although the area had been broken down into individual grazing allotments, there were few fences, and grazing was more or less on a community-allotment basis. Grazing use was excessive but fairly uniform.

During the first two winters of study (1954-55 and 1955-56) the watersheds were unfenced and were grazed as part of the open range. The next year (1956-57) the lower half of the exterior boundary was fenced. Fencing was completed June 30, 1957, and thereafter animals were confined to individual watersheds during the winter grazing seasons. Fences were constructed along the hogbacks or dividing lines between the in-

Table 1. --Average utilization and average variation of utilization from the mean on the San Luis watersheds, New Mexico, 1954-62

Years	Classes of cattle grazed	Galleta		Alkali sacaton	
		Utilization	Variation	Utilization	Variation
		Percent			
1954-55; 1955-56	Yearling steers	32	10.0	39	15.7
1956-57	Mixed herd (cows of all ages, calves, bulls, yearling steers, yearling heifers)	79	12.7	80	19.9
1957-58	Yearling heifers	24	6.3	31	7.6
1958-59	Old cows and calves	21	14.6	46	27.7
1959-60; 1960-61; 1961-62	Young cows and calves	26	17.1	62	33.4

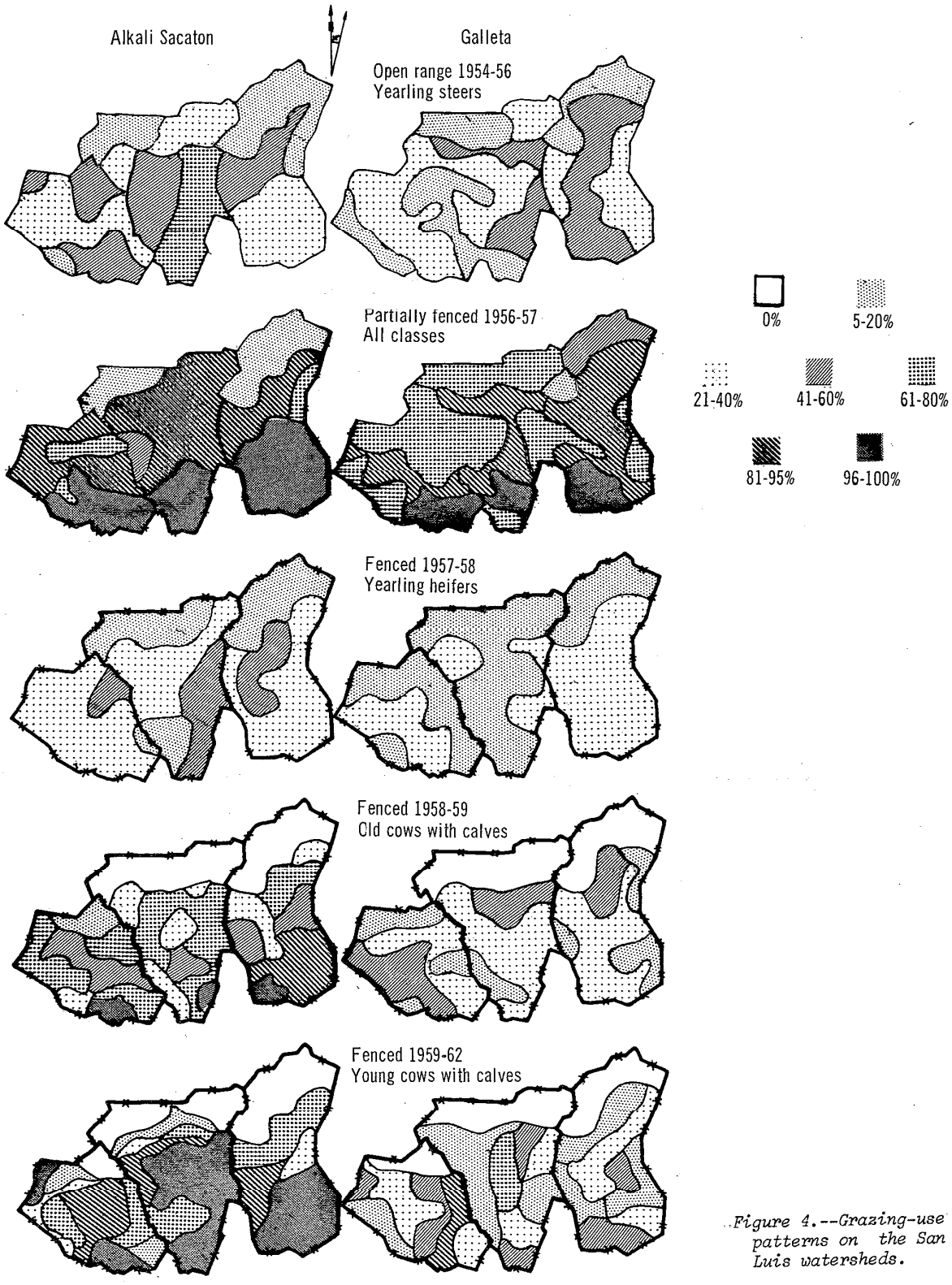


Figure 4.--Grazing-use patterns on the San Luis watersheds.

dividual watersheds. Consequently, cattle did not walk these fence lines and utilization patterns were not influenced by the presence of these fences.

Forage utilization was estimated on each of the three watersheds at the end of each grazing period. The ocular-estimate-by-plot method[6] was used on 9.6-square-foot plots to determine utilization.

Located at random in each watershed were 24 clusters of 9 permanent plots each--a total of 648 plots for the study site.

Stocking rates on the three watersheds were adjusted annually on the basis of forage production estimates made each fall after the termination of growth. Forage production was determined by the double sampling technique.[7] Estimates of weight, by species, were made on each permanent plot. These estimates were then adjusted by a regression developed from estimated and harvested weights of herbage on one temporary plot located near each of the 72 clusters of permanent plots. Grass plants on these 72 temporary plots were clipped to within three-quarters of an inch of the root crown.

Observations of cattle movement and behavior were recorded for a minimum of 1 day per week throughout each grazing season.

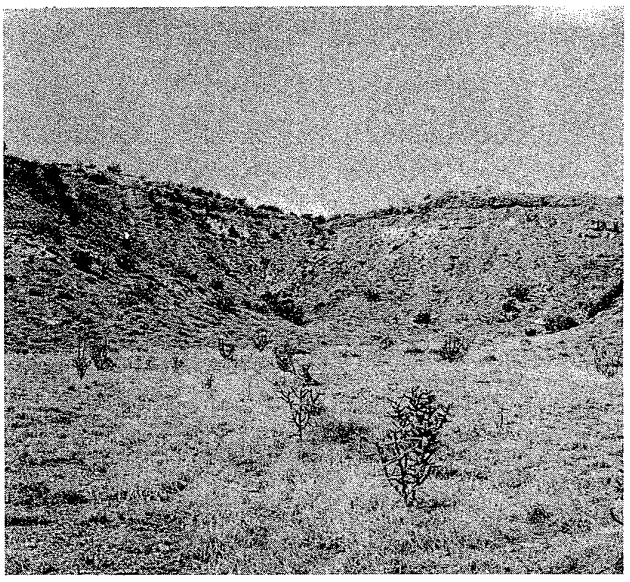
RESULTS

Since each class of livestock behaved and grazed differently on the three topographic types, the results are presented by the year or years in which each class was used.

1954-55, 1955-56.--The watersheds were grazed as part of the open range before they were fenced. Although other classes of cattle had access to the watersheds, use during these 2 years was predominantly by yearling steers. During the period, grazing was fairly uniform (fig. 4, table 1). The uplands to the north were used only slightly less than the flat or gently sloping alluvium closer to water. The rocky breaks appeared to present a challenge to yearling steers. At any rate, they tended to graze outlying areas, walk to water, drink and rest, then walk back to distant localities before grazing again. Consequently, use around watering tanks was no heavier than it was in some of the more distant areas.

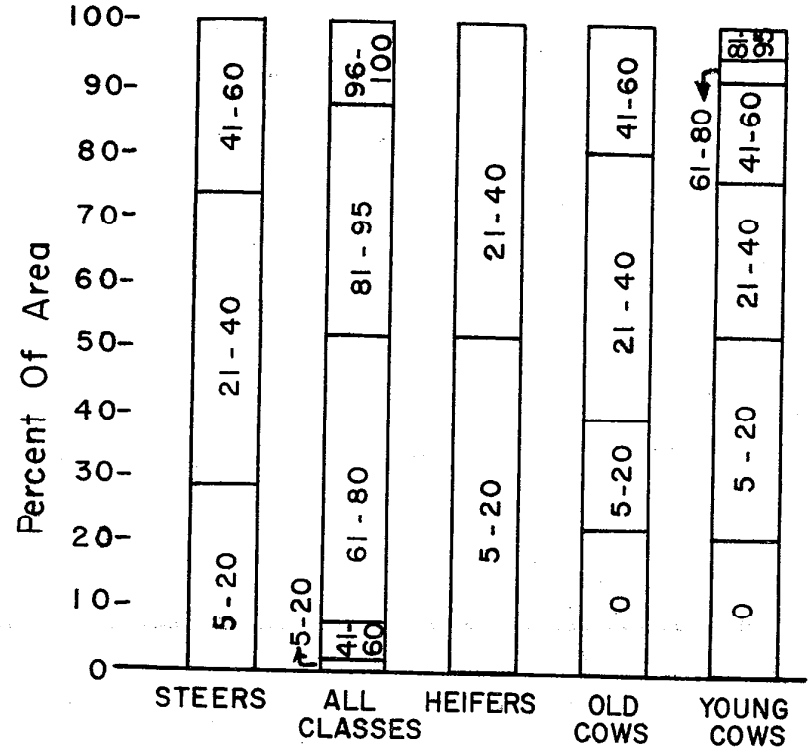
1956-57.--The east, west, and south boundary fences served as a funnel to the only water in the immediate area, which was located at the extreme southern end of each watershed. Lack of complete control prior to fencing resulted in nearly doubling the anticipated stocking of the three watersheds. Although utilization on all three watersheds was heavy, it was fairly uniform except on areas immediately surrounding the stock tanks. Here utilization of the principal forage species averaged 98 percent. Cows and calves tended to use the juniper areas or areas sheltered by the breaks (fig. 5). Cows also spent a great deal of time around water. Bulls spent most of their time around water and seldom moved as far north as the other classes of cattle, except when following a cow in heat. Yearlings continued to use the uplands.

Figure 5.--Sheltered areas, such as this, received extremely heavy use from cows and calves.

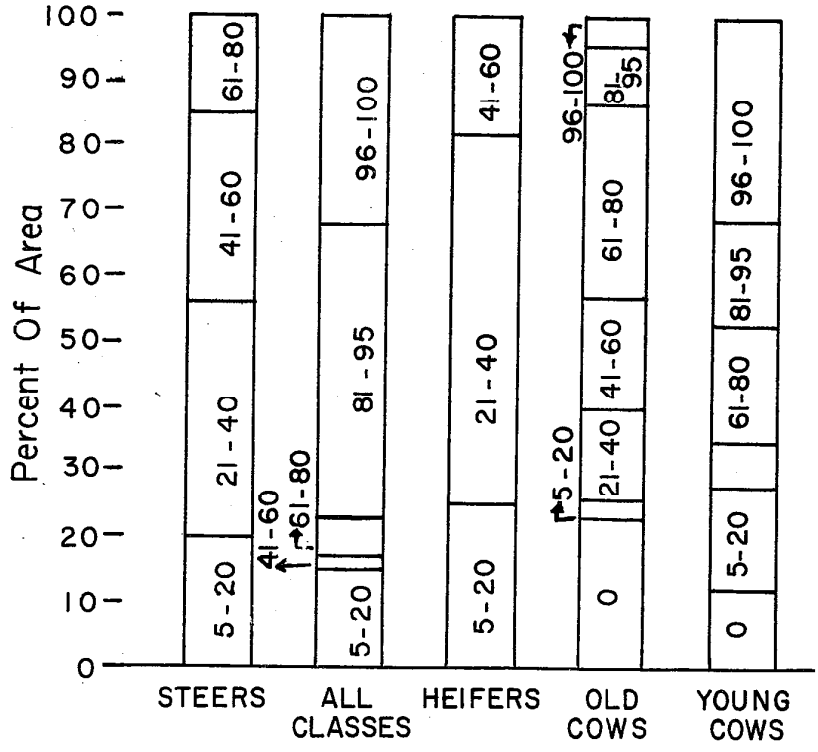


[6] *Pechanec, J. F., and Pickford, G. D. A comparison of some methods used in determining percentage utilization of range grasses. Jour. Agr. Res. 54: 753-765. 1937.*

[7] *Wilm, H. G., Costello, David F., and Klipple, G. E. Estimating forage yield by the double sampling method. Amer. Soc. Agron. Jour. 36: 194-203. 1944.*



GALLETA



ALKALI SACATON

Figure 6.-- Variation in use of galleta and alkali sacaton by classes of grazing stock.

1957-58.--This was the first season the watersheds were fenced so that cattle could be kept continuously on each watershed during the grazing season. The watersheds were stocked with yearling heifers. Utilization was more uniform than in previous years. Although use tended to be slightly heavier on the more accessible terrain, it was quite uniform over each watershed. The heifers readily negotiated the steep rocky breaks to graze the uplands. When not grazing they spent a great deal of time on the rock bluffs looking around. The alluvial bottomlands were grazed as the yearlings traveled from the uplands to water and back. Utilization near the reservoirs was less than during any other year of the study. The low average variation of use (table 1, fig. 6), revealed that yearling heifers were much more active than yearling steers and grazed an area more uniformly.

1958-59.--The three watersheds were stocked with weak old cows (7 years old or more) that calved in January, February, and March. During the first few days of the grazing season, the cows grazed over large portions of the watershed. They then used accessible areas that were protected from the weather by pinyon-juniper clumps or ridges, and completely ignored the uplands. Cows continued to graze these protected areas to the virtual exclusion of all other areas. Good, accessible, but unprotected grassland with flat or gently sloping terrain was ignored until, after approximately 16 weeks of grazing, the cows were forced out of the more sheltered areas due to lack of forage.

1959-60, 1960-61, 1961-62.--During these 3 years, the watersheds were stocked with young cows (coming 3 years old up to 7 years old) that calved in January, February, and March. These cows also grazed over large portions of the watersheds during the first few days. Instead of moving to the protected sites, however, they moved to the open alluvial grasslands. They used the sheltered areas only to calve and during periods of inclement weather. As forage in the lower, alluvial grasslands declined, the young cows used the outer edges of the more difficult terrain, uplands, and breaks. When grazing in steeper terrain, the cows left their calves hidden in the sheltered areas or in the sagebrush flats surrounding the water. Utilization in the vicinity of water was heavier than at any other time except in 1956-57 when cows, as well as other classes of cattle, were present.

CONCLUSIONS

1. Utilization patterns on small watersheds grazed by yearling cattle were about the same before and after fencing.

2. Yearling cattle utilize grasses more uniformly over variable terrain than do either cows with calves or mixed classes of cattle.

3. Yearling heifers are more active than yearling steers on steep, rocky terrain.

4. Cows and calves tend to utilize alkali sacaton and galleta immediately surrounding water much more heavily than do yearlings.

5. Old cows with calves tend to utilize the sheltered areas predominantly, and enter open terrain only when forced out due to lack of forage.

6. Young cows with calves use the open grasslands more than old cows, and enter the edges of the more inaccessible terrain only when faced with a lack of forage.

7. On rough terrain more uniform utilization may be attained by grazing with yearling heifers. When grazed as open range, mixed classes give most uniform use.